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Appl. No. 10/783,495
Reply to Office Action of March 26, 2007Attorney Docket No.: N1085-00251
[TSMC2003-0834]REMARKS

Claims 1-22 are pending in the present application and each has been rejected. Claims 1, 12, 16, 17, 18, 21 and 22 are amended herein. Applicants respectfully request re-examination, reconsideration and allowance of each of pending claims 1-22.

Claim Rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a)

The Action rejects Claims 1-4 and 9-11 under 35 U.S.C. § 102(b), for allegedly being anticipated by U.S. Patent No. 5,409,538 to Nakayama et al. ("Nakayama"). Applicants submit that Claims 1-4 and 9-11 are not anticipated by Nakayama for at least the following arguments.

First, Applicants point out that the Action concedes that "Nakayama does not expressly teach a control signal of critical dimension" as recited in Claim 1. (Page 14, top line), emphasis added.

Further, Claim 1 has been amended to recite "a patterned wafer substrate" and "... controlling the exposure energy with a feedback process control signal of critical dimension . . . the critical dimension being one of a width, a spacing and an opening of the patterned wafer substrate." (Emphasis added).

Nakayama is directed to a method of irradiating a substrate with light to measure variations in optical properties, such as reflectivity, refractive index, transmittance, polarization and spectral transmittance, for determining a photolithographic process. (see Abstract). As known in this field, optical properties are different from and do NOT include critical dimension (CD). In order to measure optical properties, Nakayama is limited to using an unpatterned wafer and therefore cannot and does not use the claimed patterned wafer substrate nor any critical dimension measurements. Nakayama does not utilize feedback or feed forward signals based on any critical dimension measurements, much less the recited critical dimensions of a width, a spacing and an opening, to control an exposure energy.

Therefore, Nakayama fails to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension, the critical dimension being a width, a

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spacing and an opening. Based on the foregoing, Claim 1 is not anticipated by Nakayama. Withdrawal of the rejection of Claim 1 in view of Nakayama is therefore respectfully requested.

Claim 2-4 and 9-11 depend from Claim 1 and are therefore also distinguished from Nakayama. Withdrawal of the rejections of Claims 2-4 and 9-11 in view of Nakayama is therefore respectfully requested.

The Action rejects Claims 5-8 and 12-22 under 35 U.S.C. § 103(a), for allegedly being unpatentable over Nakayama in view of U.S. Patent No. 6,789,529 to Saka et al. ("Saka"). Claims 16-18, 21 and 22 are amended consistently with the amendment of Claim 12.

Claims 5-8 depend from Claim 1 which is distinguished from Nakayama, as above. Saka was apparently relied upon for tracking interlayer thickness measurement after chemical mechanical planarization (CMP). However, Saka merely discloses an interlayer thickness measurement remaining after CMP. Nothing in Saka's description or drawings shows controlling the exposure energy with a feedback process control signal of critical dimension. Saka thus fails to cure the deficiency of Nakayama, i.e., both Nakayama and Saka fail to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension as set forth above in connection with Claim 1.

Because the combination of Nakayama and Saka fail to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension, a prima facie case of obviousness has not been established. Accordingly, Claims 5-8 are distinguished from, and not obvious over, Nakayama and Saka. Withdrawal of the rejections of Claims 5-8 over the combined teachings of Nakayama and Saka is respectfully requested.

Independent Claim 12 has been amended to recite "a feedback controller providing a feedback exposure energy control signal to the exposure apparatus based on critical dimension measurement of a top layer of a second patterned wafer substrate of a previous manufacturing lot, the critical dimension being one of a width, a spacing and an opening of the second patterned wafer substrate". (Emphasis added).

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For at least the reasons set forth above in conjunction with Claims 1 and 5, Claim 12 is distinguished from, and not obvious over Nakayama and Saka. Withdrawal of the rejection of Claim 12 in view of Nakayama and Saka is respectfully requested.

Claims 13-22 depend from Claim 12 and are similarly distinguished from, and not obvious over the combined teachings of Nakayama and Saka by virtue of their dependencies. Withdrawal of the rejection of Claims 13-22 under 35 U.S.C. § 103(a), in view of Nakayama and Saka is respectfully requested

The Action also rejects Claims 1-4 and 9-11 under 35 U.S.C. § 102(b), for allegedly being anticipated by or, in the alternative, under 35 U.S.C. § 103(a), for allegedly being obvious over Nakayama in view of U.S. Patent Publication No. 2004/0092047 to Lymberopoulous et al. ("Lymberopoulous"). Claims 1-4 and 9-11 are not obvious over the combined teachings of Nakayama and Lymberopoulous for at least the reasons set forth below.

As conceded by the Action, "Nakayama does not expressly teach a control signal of critical dimension." Accordingly, Nakayama also fails to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension, the critical dimension being a critical dimension of a patterned wafer substrate and being one of a width, a spacing and an opening.

The Action relies on Lymberopoulous, alleging that Lymberopoulous discloses a wafer measuring tool where CD is optically measured on a patterned photoresist layer and that one of ordinary skill in the art would modify Nakayama's method in view of Lymberopoulous' description to achieve the features recited in Claim 1. Applicants respectfully disagree.

Lymberopoulous is directed to a method for reducing CD variations in semiconductor wafers without reducing throughput. Though measuring CD at steps 1030 and 1110, Lymberopoulous merely calibrates CDs and selects etch recipes based on measured ADI (after develop inspect) and AEI (after etch inspect) CDs, such that CD of the measured pattern does not fall out of the pre-determined specification. Nothing in Lymberopoulous' description or drawings shows controlling the exposure energy with a feedback process control signal of critical dimension directed to the exposure apparatus/step. Accordingly, Lymberopoulous fails

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to make up for the deficiencies of Nakayama and fails to teach or suggest the features set forth above.

Based on the foregoing, Nakayama and Lymberopoulous fail to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension as set forth above. A prima facie case of obviousness has not been established. Claim 1 is thus not obvious over Nakayama and Lymberopoulous. Withdrawal of the rejection of Claim 1 in view of Nakayama and Lymberopoulous is respectfully requested.

Claims 2-4 and 9-11 depend from Claim 1, and are therefore distinguished from, and not obvious over, Nakayama and Lymberopoulous by virtue of their dependencies. Withdrawal of the rejections of Claims 2-4 and 9-11 in view of Nakayama and Lymberopoulous is respectfully requested.

The Action also rejects Claims 5-8 and 12-22 under 35 U.S.C. § 103(a), for allegedly being obvious over Nakayama in view of Lymberopoulous and further in view of Saka. Claims 5-8 and 12-22 are not obvious over the art of record for at least the reasons set forth below.

Claims 5-8 depend from Claim 1, which is distinguished from Nakayama in view of Lymberopoulous as set forth above. Though disclosing various features, Saka fails to cure the deficiency of the combined teachings of Nakayama and Lymberopoulous, i.e., Saka also fails to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension. Since Nakayama, Lymberopoulous and Saka fails to teach or suggest controlling the exposure energy with a feedback process control signal of critical dimension, a prima facie case of obviousness has not been established. Claims 5-8 are not obvious over the art of record. Withdrawal of the rejections of Claims 5-8 is respectfully requested.

Like Claim 1, Claim 12 is distinguished from Nakayama in view of Lymberopoulous and Saka as set forth above. Claim 12 is therefore not obvious over the art of record. Withdrawal of the rejection of Claim 12 in view of Nakayama, Lymberopoulous and Saka is respectfully requested.

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Claims 13-22 depend from Claim 12. Claims 13-22 are also not obvious over the art of record by virtue of their dependencies.

From the foregoing, reconsideration and withdrawal of the rejections of Claims 1-22 are respectfully requested.

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Conclusion

In view of the foregoing amendments and remarks, Applicants submit that this application is in condition for allowance. Early notification to that effect is respectfully requested.

The Commissioner for Patents is hereby authorized to charge any fees required to give this filing effect or credit any excess payment that may be associated with this communication to deposit account 04-1679.

Respectfully submitted,



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